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Takai

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(54) **SHEET FEEDING UNIT AND IMAGE FORMING APPARATUS**

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B65H 1/26 (2006.01)
B65H 1/04 (2006.01)

(52) **U.S. Cl.**
CPC ***B65H 1/266*** (2013.01); ***B65H 1/04*** (2013.01); *B65H 2511/18* (2013.01)

(58) **Field of Classification Search**
CPC B65H 1/00; B65H 1/04; B65H 31/20; B65H 2403/41; B65H 2403/411; B65H 2405/00; B65H 2405/1116; B65H 2405/114; B65H 2511/10; B65H 2511/12; B65H 2511/18
USPC 271/171
See application file for complete search history.

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(57) **ABSTRACT**

An attachably/detachably sheet feeding unit includes a main body part, a pair of side cursors, a pair of cursor racks, a pinion and a holding member. On the main body part having a bottom plate, a sheet is placed. The side cursors are supported by the bottom plate to slide in a width direction of the sheet to restrict a position of the sheet in the width direction. The cursor racks respectively extend from the side cursors in opposing directions in the width direction. The pinion is engaged with the cursor racks. The holding member has a shaft support part rotatably supporting the pinion, is attachable/detachable to/from the bottom plate, and then, is supported to the bottom plate to move in the width direction while the pinion is engaged with the cursor racks, and is fixed to the bottom plate in an optional position in the width direction.

8 Claims, 10 Drawing Sheets

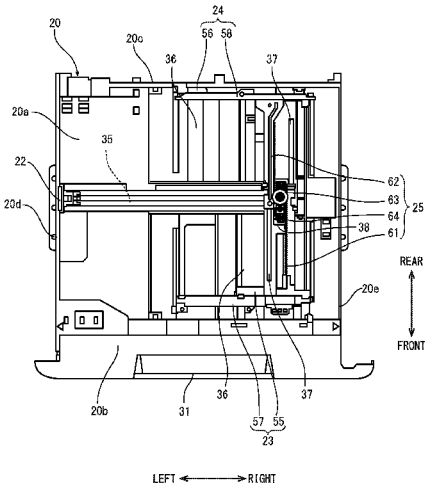


FIG. 1

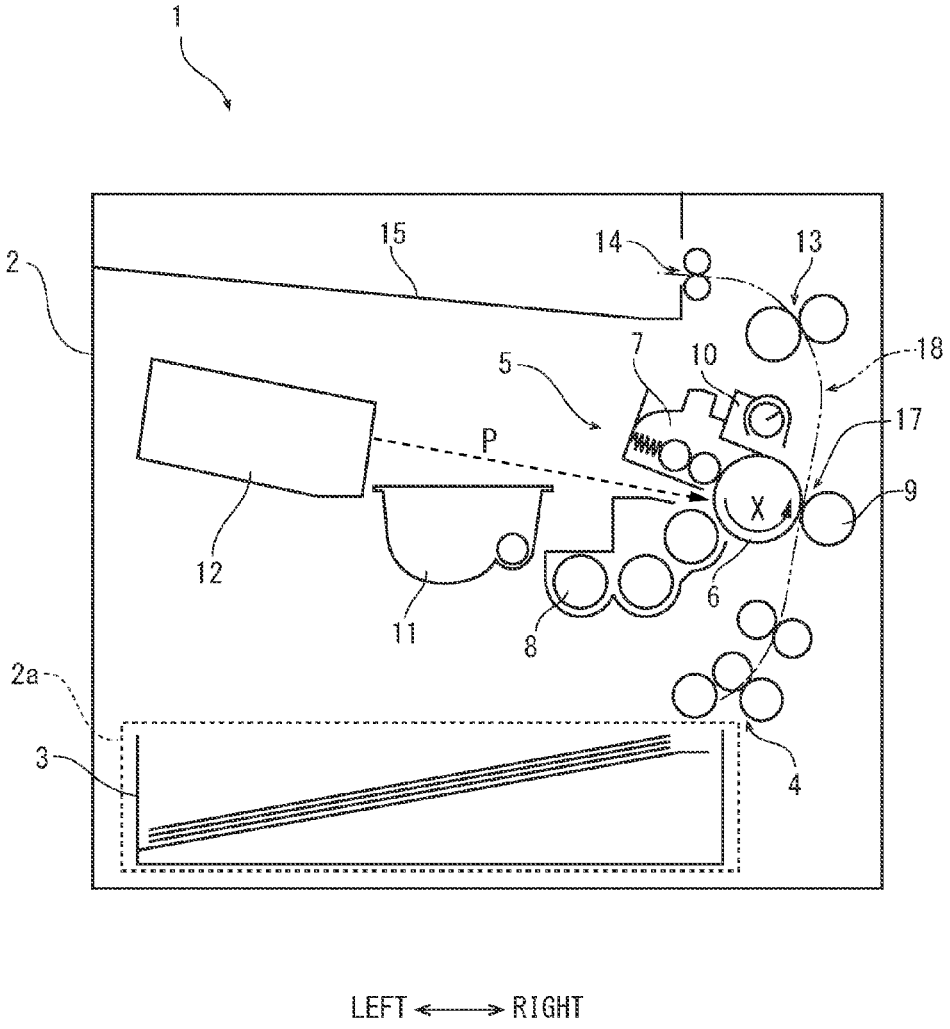


FIG. 2

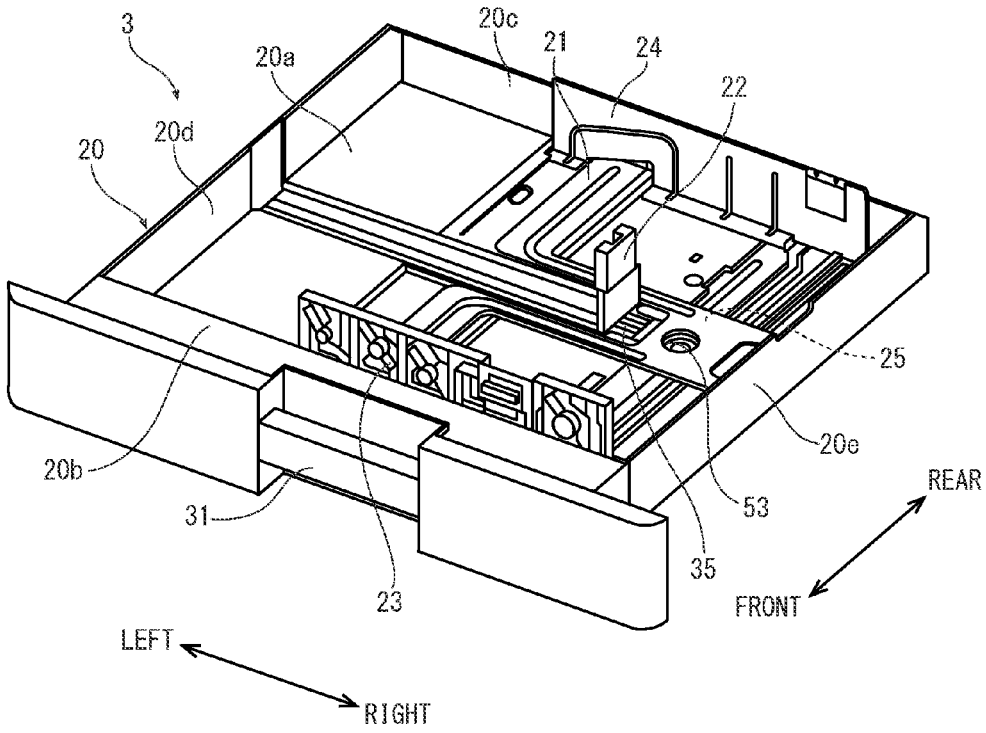

3
20a
20c
21
24
22
20d
20
25
20e
20b
31
53
35
23
REAR
FRONT
LEFT
RIGHT

FIG. 3

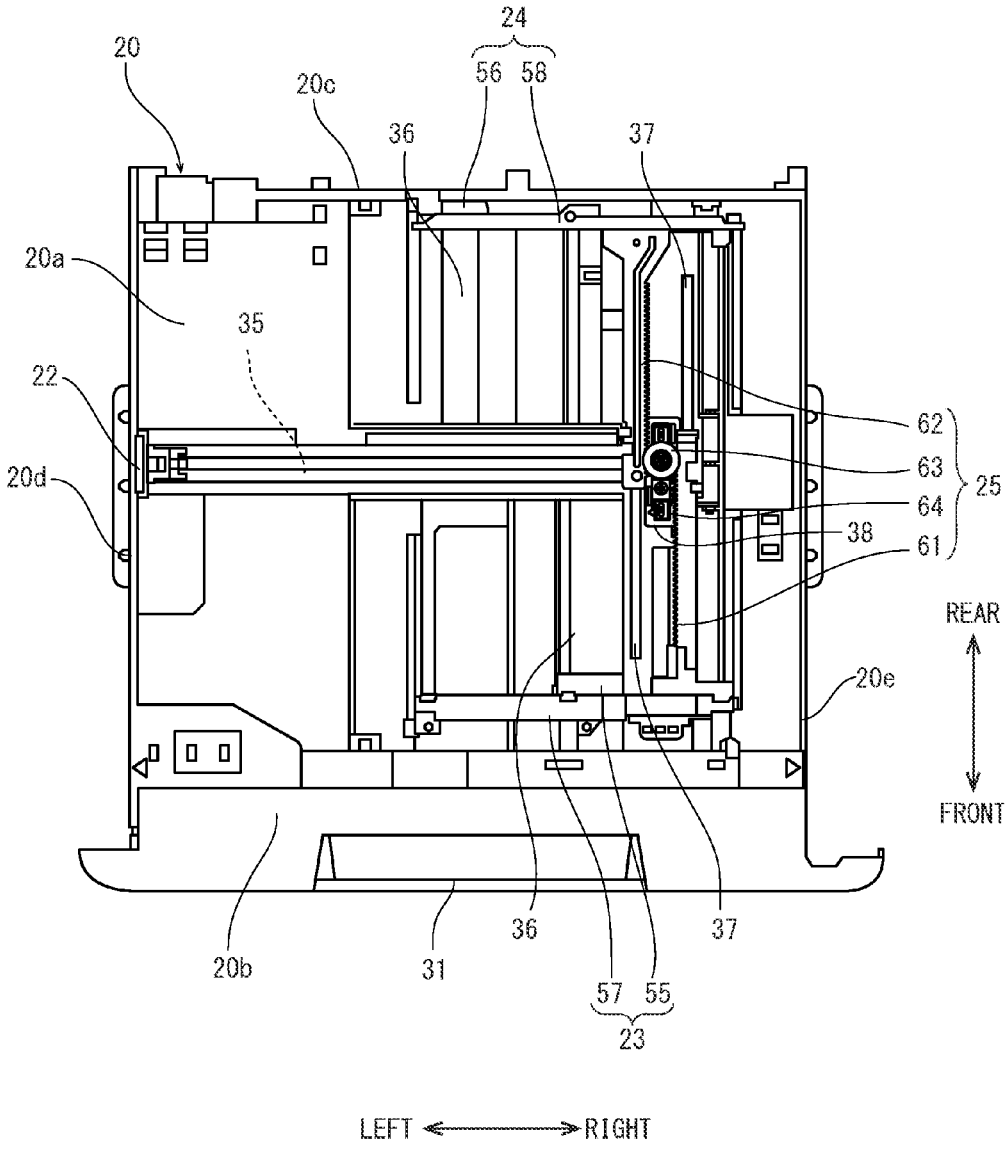

24
20
56 58
20c
36
37
20a
35
22
62
63
25
20d
64
38
61
REAR
20e
FRONT
20b
31
36
37
57 55
23
LEFT
RIGHT

FIG. 4

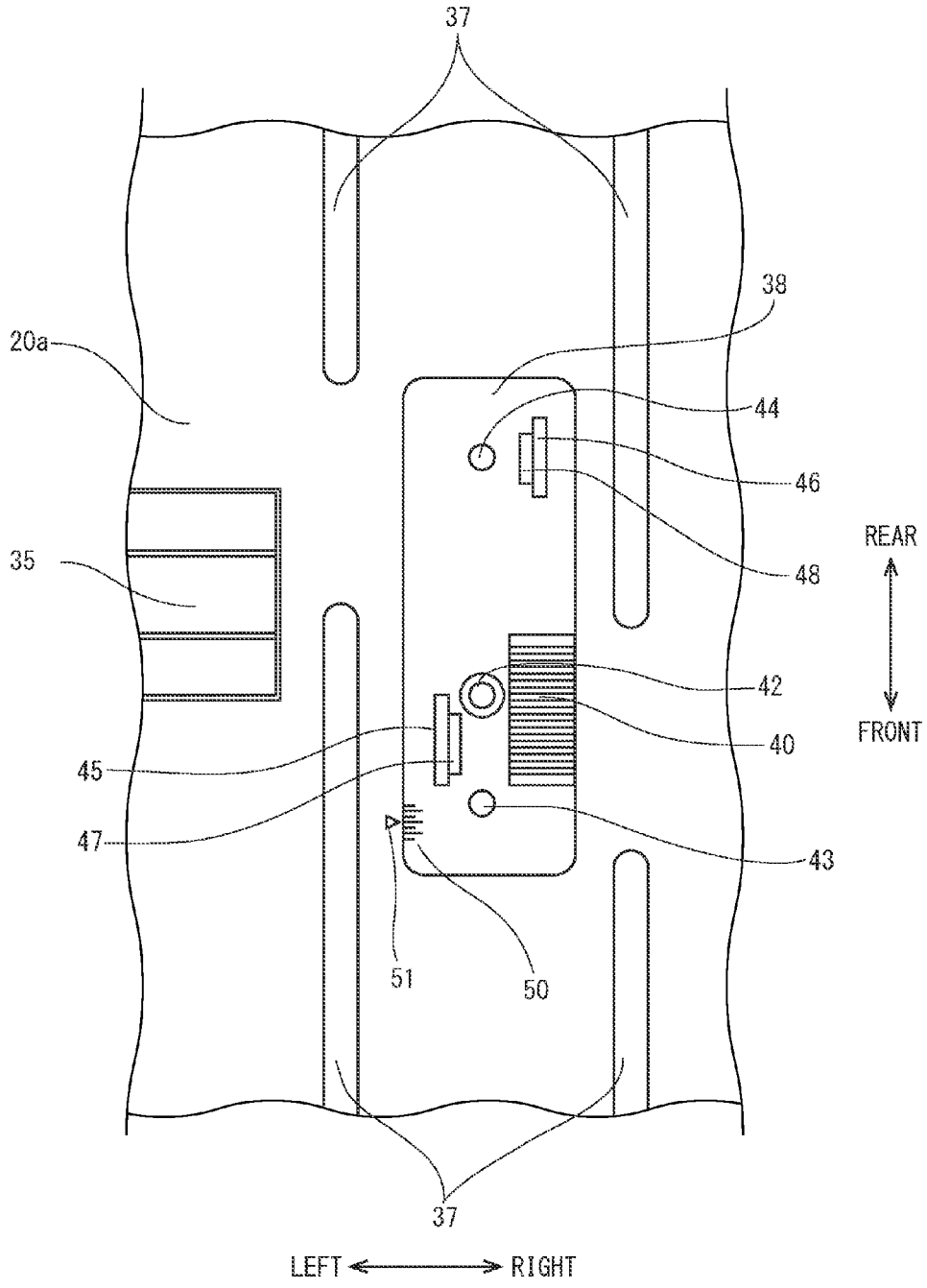


FIG. 5A

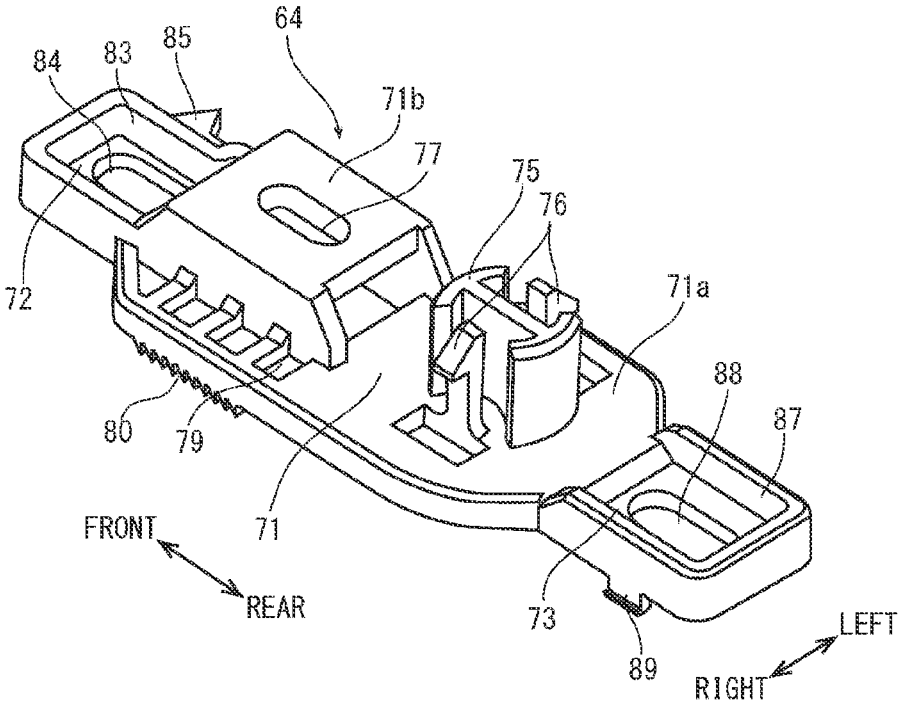

64
84
83
85
71b
77
75
76
72
71a
88
87
80
79
71
FRONT
REAR
73
89
LEFT
RIGHT

FIG. 5B

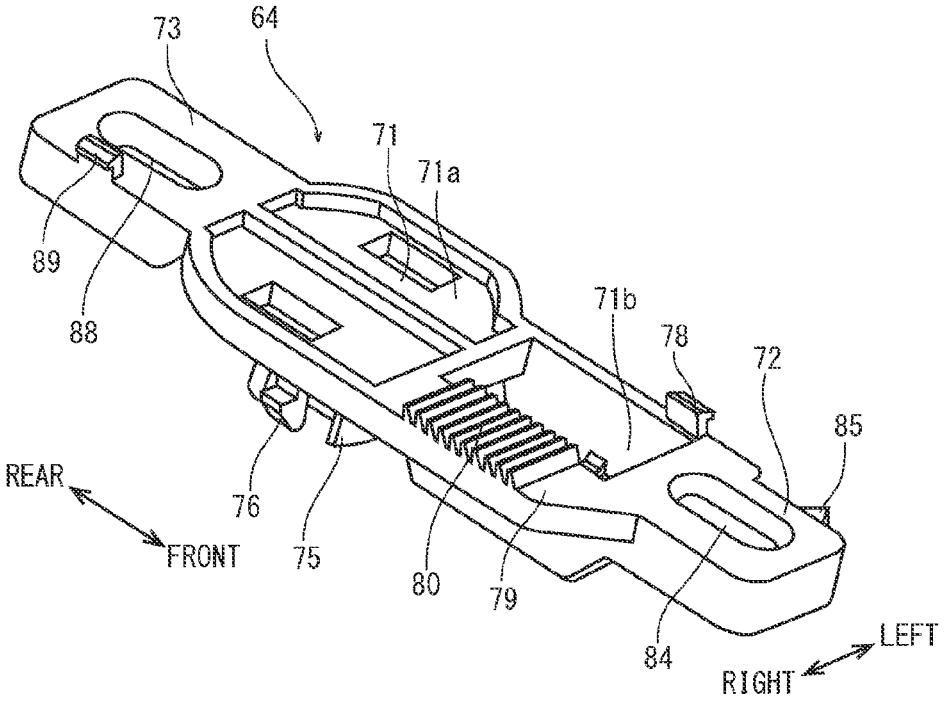

73
64
71
71a
89
88
71b
78
72
85
REAR
FRONT
76
75
80
79
84
LEFT
RIGHT

FIG. 6

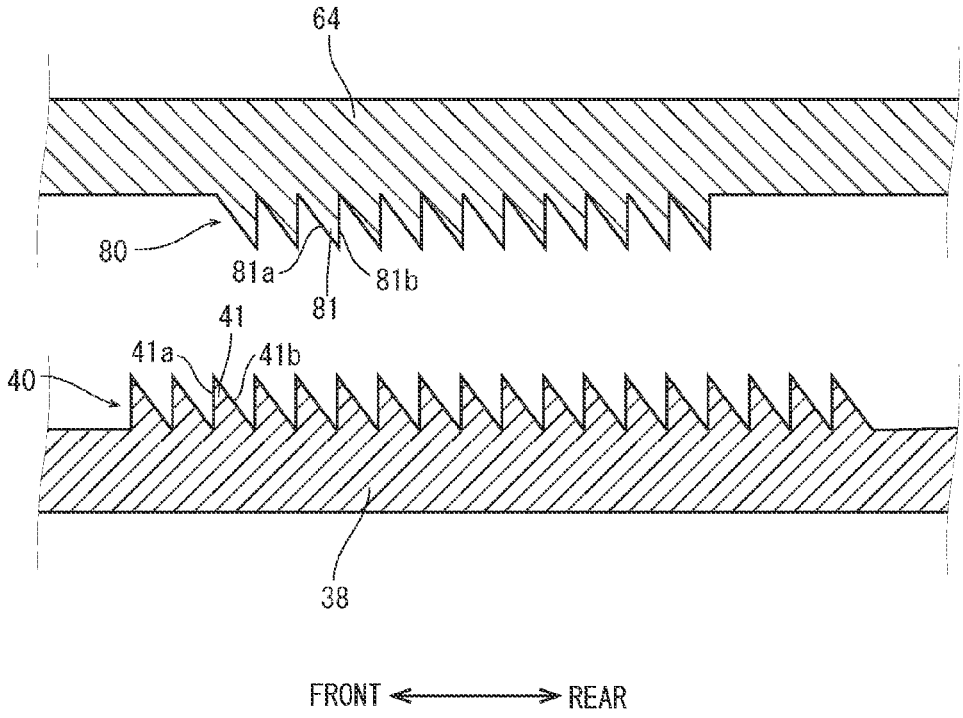


FIG. 7

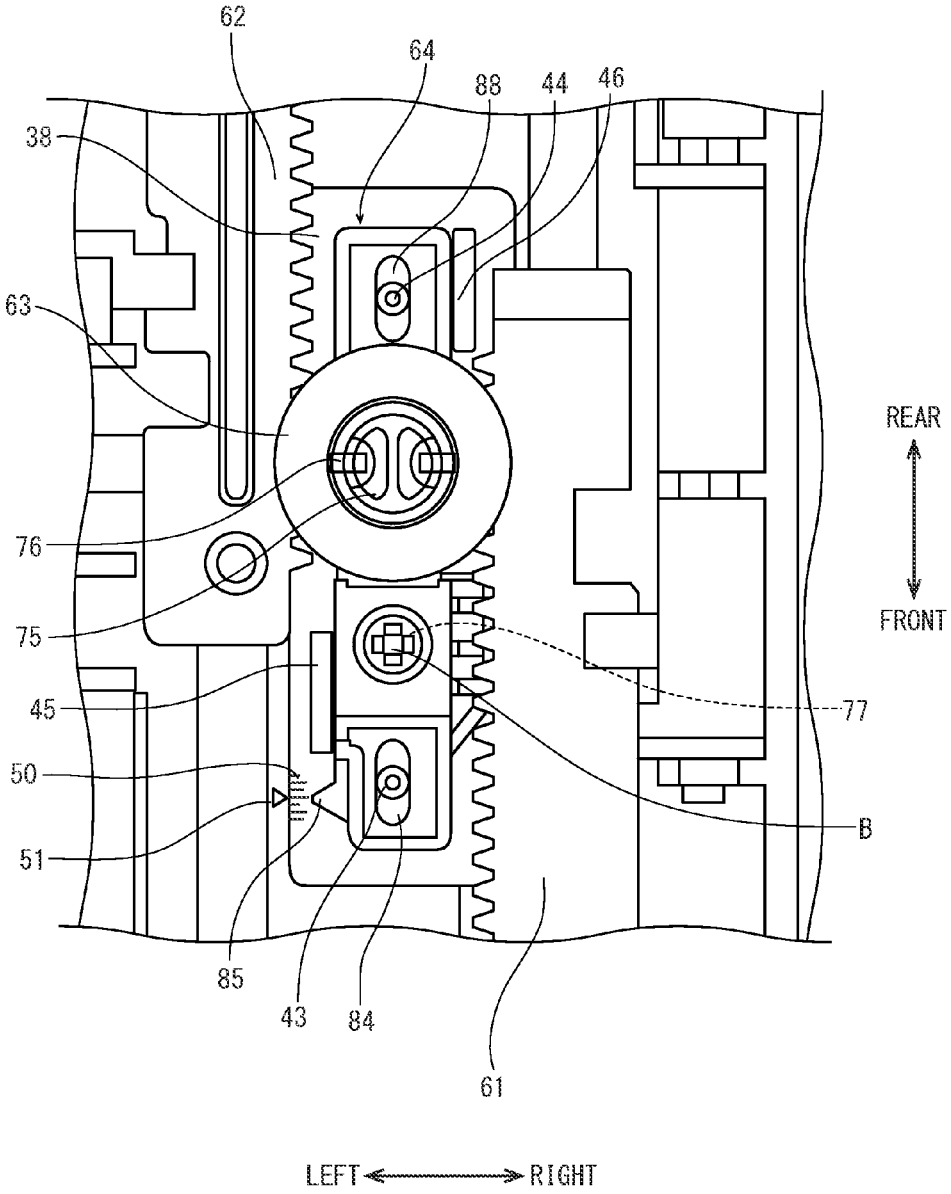

62
64
88
44
46
38
63
76
75
45
50
51
85
43
84
61
77
B
REAR
FRONT
LEFT
RIGHT

FIG. 8

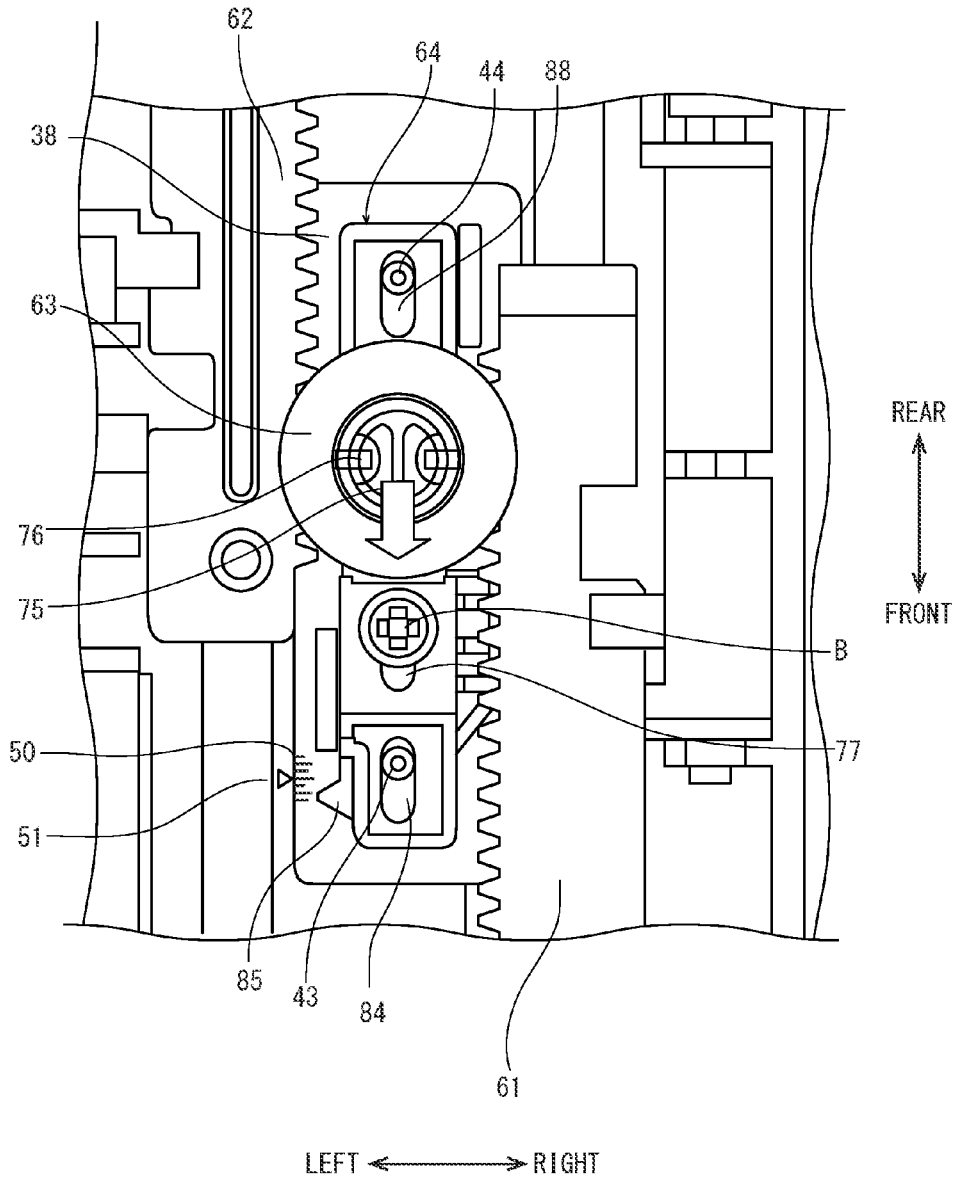


FIG. 9

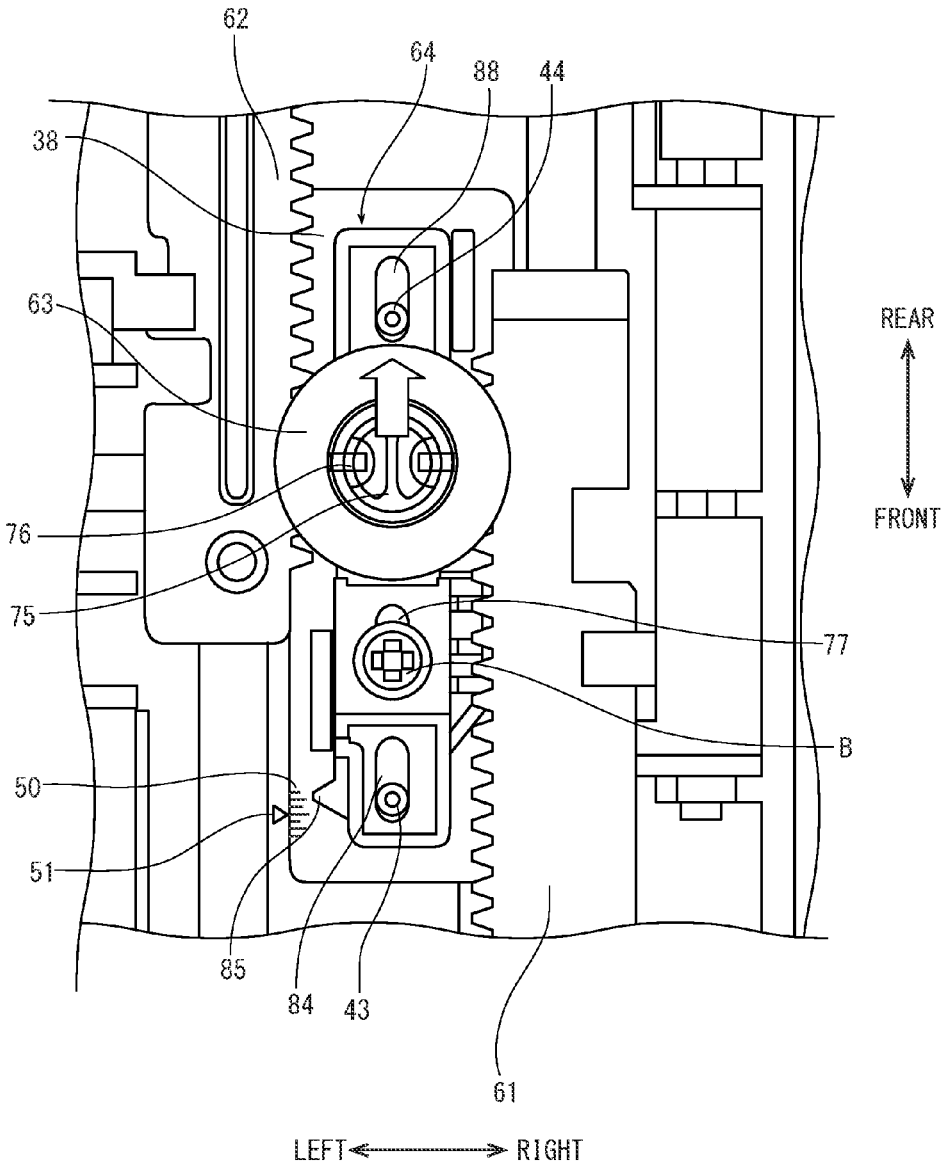
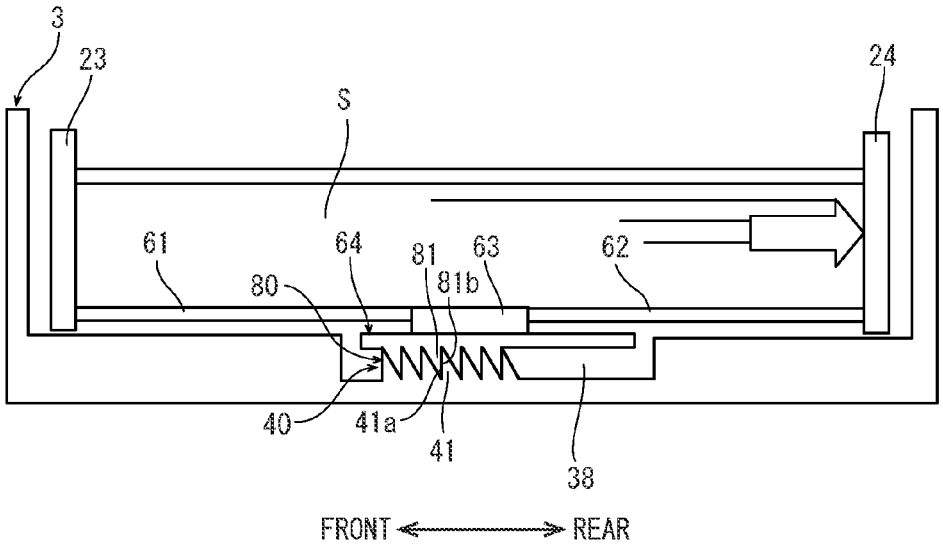


FIG. 10



SHEET FEEDING UNIT AND IMAGE FORMING APPARATUS

INCORPORATION BY REFERENCE

This application is based on and claims the benefit of priority from Japanese Patent application No. 2015-063576 filed on Mar. 26, 2015, the entire contents of which are incorporated herein by reference.

BACKGROUND

The present disclosure relates to a sheet feeding unit for storing sheets fed to an image forming apparatus or the like and an image forming apparatus including the sheet feeding unit.

In an image forming apparatus, such as a multifunction peripheral and a printer, sheets are fed from a sheet feeding unit, such as an attachably/detachably supported sheet feeding cartridge and a manual feeding tray, to an image forming part. In the sheet feeding cartridge, a pair of cursors slidably provided restrict a position of a sheet in a width direction. A mechanism for sliding the pair of cursors is generally configured to synchronously slide the pair of cursors in approaching and separating directions in the width direction of the sheets by a rack and pinion mechanism including racks respectively provided in the pair of cursors and a pinion engaged with the pair of racks.

In the sheet feeding cartridge including such a slide mechanism, it is necessary to coincide a center position of the sheet restricted by the pair of cursors (a center position between the pair of cursors) with a center position of an image formed in the image forming part. When the center position of the sheet is not coincided with the center position of the image in the width direction of the sheet, for example, in a case where a post-treatment such as opening a punch hole is performed, the punch hole interferes with the image, or in a case where multi-staged cartridges are used, the position of the punch hole is displaced in every sheet fed from each cartridge.

In order to position the center of the pair of cursors in the width direction, there is an image forming apparatus including a sheet feeding cartridge configured to support the pair of cursors and a slide mechanism and to move a support member together with the pair of cursors in the width direction.

However, in the sheet feeding cartridge as mentioned above, there is a problem that a size of the support member is enlarged and does not match a sheet feeding cartridge having a low height in recent years. In addition, there is a problem that points where the support member is fixed to the sheet feeding cartridge are increased, thereby deteriorating in workability.

On the other hand, in a sheet feeding cartridge including the pair of cursors, there is also a problem that in a case where a user inserts the sheet feeding cartridge by strong force when the user installs the sheet feeding cartridge, the force is applied from the sheets stored in the sheet feeding cartridge to the cursor and the slide mechanism, thereby resulting in displacement of the center position of the pair of cursors in the width direction.

SUMMARY

In accordance with the present disclosure, a sheet feeding unit is attachable to and detachable from an apparatus main body and includes a main body part, a pair of side cursors, a pair of cursor racks, a pinion and a holding member. The main body part has a bottom plate and is configured to be arranged on which a sheet is placed. The pair of side cursors are supported by the bottom plate so as to slide in a width direction of the sheet to restrict a position of the sheet in the width direction. The pair of cursor racks respectively extend from the pair of side cursors in directions opposing to each other in the width direction of the sheet. The pinion is engaged with the pair of cursor racks. The holding member has a shaft support part rotatably supporting the pinion. Further, the holding member is attachable to and detachable from the bottom plate. The holding member is configured to be supported so as to move in the width direction of the sheet with respect to the bottom plate in a state that the engagement of the pinion with the pair of cursor racks is maintained, and to be fixed to the bottom plate in any optional position in the width direction of the sheet.

An image forming apparatus of the present disclosure includes the sheet feeding unit.

The above and other objects, features, and advantages of the present disclosure will become more apparent from the following description when taken in conjunction with the accompanying drawings in which a preferred embodiment of the present disclosure is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view schematically showing an internal structure of a printer according to an embodiment of the present disclosure.

FIG. **2** is a perspective view showing a sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **3** is a plan view showing a main body part of the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **4** is a plan view showing a depression formed in a bottom plate of the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **5**A is a perspective view showing a holding member seen from an upper side in the sheet feeding cartridge according to the embodiment of the present disclosure, and FIG. **5**B is a perspective view showing the holding member seen from a lower side in the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **6** is a side sectional view showing a first rack part and a second rack part in the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **7** is a plan view showing the holding member installed on the main body part in the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **8** is a plan view showing a pinion holding member in a state that a pair of cursors are moved forwardly in the sheet feeding cartridge according to the embodiment of the present disclosure.

FIG. **9** is a plan view showing the pinion holding member in a state that the pair of cursors are moved backwardly in the sheet feeding cartridge according to the one embodiment of the present disclosure.

FIG. **10** is a sectional view schematically showing the sheet feeding cartridge when the holding member behaves in accordance with strong insertion of the sheet feeding cartridge according to the embodiment of the present disclosure.

DETAILED DESCRIPTION

Hereinafter, with reference to the attached drawings, an image forming apparatus according to an embodiment of the present disclosure will be described.

First, with reference to FIG. **1**, the entire configuration of a printer **1** as an image forming apparatus will be described. FIG. **1** is a schematic diagram schematically showing the printer according to the embodiment of the present disclosure. Hereinafter, it will be described so that the front side of the printer **1** is positioned at the front side of FIG. **1**, and left and right directions are defined with reference to a direction when seeing the printer **1** from the front side.

The printer **1** includes a roughly rectangular parallelepiped housing **2** (an apparatus main body) having a hollow part. In a lower part of a front face of the housing **2**, an opening part **2***a* is formed. Into the opening part **2***a*, a sheet feeding cartridge **3** (a sheet feeding unit) storing sheets is attachably/detachably installed in forward and backward directions. At a right upper side of the sheet feeding cartridge **3**, a sheet feeding device **4** feeding sheets from the sheet feeding cartridge **3** is provided.

Above the sheet feeding device **4**, an image forming part **5** is provided. In the image forming part **5**, a photosensitive drum **6** is rotatably provided. Around the photosensitive drum **6**, a charging device **7**, a development device **8**, a transferring roller **9** and a cleaning device **10** are located along a rotation direction of the photosensitive drum **6** (refer to an arrow X in FIG. **1**). The development device **8** is connected to a toner container **11**. In addition, at a left side of the image forming part **5**, an exposure device **12** composed of a laser scanning unit (LSU) is provided.

Above the image forming part **5**, a fixing device **13** is provided. At the left side of the fixing device **13**, a sheet ejecting part **14** is provided. The sheet ejecting part **14** faces to an ejected sheet tray **15** formed on an upper surface of the housing **2**.

In addition, inside the housing **2**, a sheet conveyance path **18** is provided so as to travel from the sheet feeding device **4**, to pass through a transferring nip formed between the photosensitive drum **6** and the transferring roller **9** and the fixing device **13** and to go toward the sheet ejecting part **14**.

Next, the operation of forming an image by the printer **1** having such a configuration will be described. After a surface of the photosensitive drum **6** is electrically charged by the charging device **7**, exposure corresponding to image data is carried out to the photosensitive drum **6** by a laser light (refer to an arrow P) from the exposure device **12**. Thereby, an electrostatic latent image is formed on the surface of the photosensitive drum **6**. The electrostatic latent image is developed to a toner image by the development device **8**. Toner remained on the photosensitive drum **6** is removed by the cleaning device **10**.

On the other hand, the sheet fed from the sheet feeding cartridge **3** to the conveyance path **18** by the sheet feeding device **4** is conveyed to the transferring nip **17** in a suitable timing for the above-mentioned image forming operation. Then, in the transferring nip **17**, the toner image on the photosensitive drum **6** is transferred onto the sheet. The sheet with the transferred toner image is conveyed to a downstream side on the conveying path **18** to enter the fixing device **13**, and then, the toner image is fixed on the sheet in the fixing device **13**. The sheet with the fixed toner image is ejected from the sheet ejecting part **14** onto the ejected sheet tray **15**.

Next, with reference to FIG. **2** to FIG. **6**, the sheet feeding cartridge will be described. FIG. **2** is a perspective view of the sheet feeding cartridge, FIG. **3** is a plan view of a main body part of the sheet feeding cartridge, FIG. **4** is a plan view showing a part of a bottom plate of the main body part, FIG. **5**A and FIG. **5**B are perspective views showing a holding member, FIG. **6** is a side sectional view showing a first rack part and a second rack part. In the following description, left and right directions designate a conveyance direction of the sheet, and the forward and backward directions designate a width direction of the sheet.

The sheet feeding cartridge **3**, as shown in FIG. **2**, includes a main body part **20** in which the sheet is stored, an elevating plate **21** on which the sheet is stacked in the main body part **20**, an end cursor **22** slidably supported in the conveyance direction of the sheet, a front cursor **23** and a rear cursor **24** (a pair of side cursors) slidably supported in the width direction of the sheet and a slide mechanism **25** provided between the front cursor **23** and the rear cursor **24** to slide both the cursors.

The main body part **20** has a shallow box-like shape of which an upper face is opened. The main body part **20** includes a bottom plate **20***a*, front and rear side plates **20***b* and **20***c*, and left and right side plates **20***d* and **20***e*. In the front side plate **20***b*, a grip **31** for pulling out the sheet feeding cartridge is provided.

In the bottom plate **20***a*, as shown in FIG. **3**, at a center in the forward and backward directions, a central groove **35** shallowly extending in the left and right directions is formed. In addition, in the bottom plate **20***a*, at both front and rear sides positioned across a central groove **35**, respective guiding depressions **36** extending in the forward and backward directions, and a pair of respective guiding grooves **37** extending parallel to each other in the forward and backward directions are formed. The guiding depressions **36** are formed in the vicinity of the center in the left and right directions, and the pair of guiding grooves **37** are formed at a right side from the guiding depressions **36**. Between the pair of front and rear guiding grooves **37**, a rectangular depression **38** elongated in the forward and backward directions is formed.

With reference to FIG. **4**, the depression **38** will be described. In the depression **38** on an upper face of the bottom plate **20***a*, a first rack part **40** is formed along a right edge in a position at a front side from the center in the forward and backward directions. As shown in FIG. **6**, in the first rack part **40**, teeth **41** extending in the left and right directions are formed at predetermined pitches along the forward and backward directions. Each of the teeth **41** is formed so as to have a cross section of a right triangle shape and to have a front side face **41***a* as a perpendicular face and a rear side face **41***b* as an inclined face.

Further, in the depression **38**, as shown in FIG. **4**, at a left side of the first rack part **40**, a boss **42** in which a screw hole is formed is vertically arranged. In addition, at front and rear sides of the boss **42** (at both sides of the boss **42** in the width direction), front and rear guiding protrusions **43** and **44** are vertically arranged, respectively. Moreover, at a left side of the boss **42** and the front guiding protrusion **43** and at a right side of the rear guiding protrusion **44**, front and rear guiding projection parts **45** and **46** extending in the forward and backward directions are formed, respectively. Furthermore, along a right edge of the front guiding projection part **45** and a left edge of the rear guiding projection part **46**, front and rear groove parts **47** and **48** extending in the forward and backward directions are formed, respectively.

In addition, on the bottom face of the depression **38**, a scale **50** marked every 1 mm along the front part of the left edge in the forward and backward directions is formed. The

scale **50** is formed within the scope of 6 mm, and a mark **51** pointing a reference position is denoted in the center of the scale **50**.

As shown in FIG. **2**, the elevating plate **21** is placed above the front cursor **23**, the rear cursor **24** and the slide mechanism **25** on the bottom plate **20***a* of the main body part **20**, and is supported so as to be inclined upwardly around a left end as a fulcrum by an elevating mechanism (not shown). In the elevating plate **21**, in the right end part at the center in the forward and backward directions, an opening **53** is formed.

The end cursor **22** is slidably supported along the central groove **35** formed in the bottom plate **20***a* of the main body part **20** in a posture erected with respect to the bottom plate **20***a*.

The front cursor **23** and the rear cursor **24** include respective engaging portions **55** and **56** engaged with the guiding depressions **36** of the bottom plate **20***a* of the main body part **20** and respective side wall parts **57** and **58** roughly erected with respect to the bottom plate **20***a* and extending in the left and right directions. The engaging portions **55** and **56** are guided along the guiding depressions **36**, and then, the side wall parts **57** and **58** come into contact with both side edges of the sheet in the width direction.

The slide mechanism **25** includes a pair of cursor racks **61** and **62** respectively provided in the front cursor **23** and the rear cursor **24**, a pinion **63** engaged with the pair of cursor racks **61** and **62**, and a holding member **64** supporting the pinion **63**.

The cursor racks **61** and **62** are extended in directions opposing to each other from in a position displaced in the left and right direction of the front cursor **23** and the rear cursor **24** and, on respective opposing faces of the cursor racks **61** and **62** in the left and right directions, rack teeth are formed. Each of the cursor racks **61** and **62** are engaged with one of parallel guiding grooves **37** formed in the bottom plate **20***a* of the main body part **20**, and guided along the guiding grooves **37** in the forward and backward directions. The pinion **63** has a pinion gear meshing with the rack teeth of the cursor racks **61** and **62**. The pinion gear is formed so as to have a width broader than the rack teeth of the cursor racks **61** and **62**.

The holding member **64** will be described with reference to FIG. **5**. FIG. **5**A is a perspective view of the holding member seen from an upper side, and FIG. **5**B is a perspective view of the holding member seen from a lower side. FIG. **5**A differs in the left and right directions from FIG. **5**B, that is, the left and right directions are reverse. The holding member **64** is a rectangular plate-like member elongated in the forward and backward directions, and has a front end part **72** and a rear end part **73**, and a center part **71** between the front end part **72** and the rear end part **73**.

A center rear part **71***a* at a rear side in the center part **71** is formed so that a left end of a roughly circular shape in a planar view is cut out along a chord extending in the forward and backward directions. At the center of the center rear part **71***a*, a boss-like shaft support part **75** having a roughly H-shape seen from a lateral section is vertically arranged. Further, on diagonal locations across the shaft support part **75**, a pair of claw parts **76** are vertically arranged so as to elastically deform in a diameter direction of the shaft support part **75**.

A center front part **71***b* at a front side in the center part **71** has a hollow truncated square pyramid shape of which front and rear end faces and a lower surface are opened. At the center of the center front part **71***b*, a long hole **77** elongated in the forward and backward directions is formed. The long hole **77** is formed on the same coordinate in the left and right directions as the center of the shaft support part **75**. In addition, in the center front part **71***b*, a claw part **78** extending downwardly from a part of a left edge is formed. Further, in the center front part **71***b*, an extending part **79** extending from a right edge toward a right side is formed so as to continue from the center rear part **71***a*.

In a lower face of the extending part **79**, a second rack part **80** engaging with the first rack part **40** formed in the depression **38** of the main body part **20** is formed. As shown in FIG. **6**, in the second rack part **80**, teeth **81** meshing with the teeth **41** formed in the first rack part **40** are formed along the forward and backward directions at predetermined pitches. That is, each of the teeth **81** is formed so as to have a front side face **81***a* as an inclined face and a rear side face **81***b* as a perpendicular face.

The front end part **72** is configured so that an upper face is surrounded a rib **83** along an outer circumference edge and a front slit **84** elongated in the forward and backward directions is formed at the center. The front slit **84** is formed on the same coordinate in the left and right directions as the long hole **77**. Further, in the front end part **72**, a point protrusion **85** (a point part) having a triangle shape in a planar view and protruding from a left edge is formed.

The rear edge part **73** is configured so that an upper face is surrounded by a rib **87** along the outer circumference edge and a rear slit **88** elongated in the forward and backward directions is formed at the center. The rear slit **88** is formed on the same coordinate in the left and right directions as the long hole **77**. In other words, the front slit **84** and the rear slit **88** are arranged at both sides of the long hole **77** in the width direction. Further, in the rear edge part **73**, a claw part **89** extending downwardly from a right edge of is formed.

In the holding member **64** having the configuration as described above, the pinion **63** is rotatably supported by being inserted into the shaft support part **75** vertically arranged in the center rear part **71***a* and being retained by the pair of claw parts **76**.

With reference to FIG. **7**, a procedure for assembling the front cursor **23** and the rear cursor **24** with the main body part **20** will be described. FIG. **7** is a plan view showing a holding member installed onto the depression of the main body part.

In order to assemble the front cursor **23** and the rear cursor **24**, firstly, the holding member **64** is positioned so that the point protrusion **85** formed in the front end part **72** points out the mark **51** pointing out the reference position of the scale **50** within the depression **38** formed on the bottom plate **20***a* of the main body part **20**. Subsequently, each of the teeth **81** of the second rack part **80** is meshed with each of the teeth **41** of the first rack part **40**, and the boss **42** is allowed to enter into the hollow truncated square pyramid shaped center front part **71***b*. Thereby, the front and rear guiding protrusions **43** and **44** of the depression **38** are inserted into the front and rear slits **84** and **88** formed in the front end part **72** and the rear end part **73** of the holding member **64**. In addition, the holding member **64** is slidably supported in the width direction of the sheet. Further, the respective claw parts **78** and **89** of the holding member **64** are engaged with the respective groove parts **47** and **48** of the depression **38**, the front end part **72** of the holding member and the left edge of the center front part **71***b* are arranged along the guiding projection part **45**, and the right edge of rear end part **73** of the holding member **64** is arranged along the guiding projection part **46**. In addition, the holding member **64** is attachably/detachably fixed to the depression **38** by inserting the screw B from the long hole **77** of the holding member **64**

and fastening the screw B to the boss **42** vertically arranged in the depression **38** in a state that the holding member **64** is slid to any optional position to be positioned.

Next, the front cursor **23** and the rear cursor **24** are set to a predetermined position on the bottom plate **20***a* of the main body part **20**, the engaging portions **55**, **56** are engaged with the guiding depression **36**, respectively, and the cursor racks **61**, **62** are engaged with the respective guiding grooves **37**. Finally, the pinion **63** is meshed with the cursor racks **61**, **62** while the pinion **63** is installed on the shaft support part **75** the holding member **64**. The pinion **63** is retained by the claw part **76** in a state that the pinion **63** is meshed with the cursor racks **61**, **62**. It is to be noted that the holding member **64** may be fixed to the depression **38** after the cursor racks **61**, **62** are set to a predetermined position of the bottom plate **20***a*.

After the front cursor **23** and the rear cursor **24** are assembled with the main body part **20** in such a manner, the elevating plate **21** and the end cursor **22** are assembled with the main body part **20**. When the elevating plate **21** has an uninclined posture, the pinion **63** and the screw B supported by the holding member **64** are exposed from an opening **53** (refer to FIG. **2**) formed in the right end part at the center of the vertically movable plate **21** in the forward and backward directions.

In this state, when one of the front cursor **23** and the rear cursor **24** are slid toward one direction along the guiding depression **36** by a predetermined distance, another of the front cursor **23** and the rear cursor **24** are slid toward another direction along the guiding depression **36** by the same distance as the predetermined distance to come into contact with both side edges in the forward and backward directions of the sheets mounted on the vertically movable plate **21** and to restrict the position of the sheet in the forward and backward directions.

Next, center position adjustment for matching the center of the sheet in the forward and backward directions with the center of the image in the forward and backward directions in a case where the center in the forward and backward directions of the sheet stored in the sheet feeding cartridge **3** is displaced from the center in the forward and backward directions of the image formed in the image forming part **5** will be described with reference to FIG. **8** and FIG. **9**. This center position adjustment is carried out by a service person, for example, in a case where displacement of the center position is reported. It is to be noted that, in FIG. **8** and FIG. **9**, the elevating plate **21** is not shown.

For example, it is assumed that the center of the sheet in the forward and backward directions is displaced backwardly with respect to the center of the image in the forward and backward directions by 3 mm, and it is necessary to displace the center of the sheet in the forward and backward directions forwardly by 3 mm. In this case, the screw B fastening the holding member **64** through the opening **53** of the elevating plate **21** is loosened, and then, the holding member **64** is lifted while grasping the shaft support part **75** to release the engagement of the second rack part **80** with the first rack part **40**, and moreover, the holding member **64** is manually moved forwardly. In this time, although the pinion **63** is lifted together with the holding member **64**, the engagement of the pinion **63** with the cursor racks **61** and **62** is maintained. Accordingly, the cursor racks **61** and **62** are also moved forwardly together with the holding member **64** along the guiding grooves **37** while keeping a relative position to the pinion **63**, and moreover, the front cursor **23** and the rear cursor **24** are also moved forwardly along the guiding depression **36**. It is to be noted that the holding member **64** is guided along the front slit **84**, the rear slit **88** and the guiding projection parts **45** and **46**, and then, the second rack part **80** of the holding member **64** is slid along an upper face of the first rack part **40**.

Here, as shown in FIG. **6**, since an inclined front side face **81***a* of each of the teeth **81** of the second rack part **80** comes into contact with the inclined rear side face **41***b* of each of the teeth **41** of the first rack part **40**, if the holding member **64** is slid forwardly while grasping the shaft support part **75**, the second rack part **80** is moved forwardly so that the front side face **81***a* of each of the teeth **81** runs on along the rear side face **41***b* of each of the teeth **41** of the first rack part **40**. As shown in FIG. **8**, when the holding member **64** is moved forwardly until the point protrusion **85** points out the scale **50** positioned forwardly by 3 mm from the mark **51** as the reference position, the second rack part **80** is engaged with the first rack part **40** and the holding member **64** is fastened to the depression **38** by the screw B. Thereby, the center position between the front cursor **23** and the rear cursor **24** is moved forwardly by 3 mm, and therefore, it is possible to match the center of the sheet in the width direction with the center of the image in the width direction.

On the other hand, in a case where the center of the sheet in the forward and backward direction is displaced forwardly by 3 mm with respect to the center of the image in the forward and backward directions, and it is necessary to displace the center of the sheet in the forward and backward directions backwardly by 3 mm, the screw B is loosened, and then, the holding member **64** is lifted from the depression **38** until the engagement of the second rack part **80** with the first rack part **40** is completely released, and moreover, the holding member **64** is moved backwardly. That is, in order to release the engagement of the second rack part **80** with the first rack part **40**, it is necessary that the perpendicular rear side face **81***b* of each of the teeth **81** of the second rack part is moved in a perpendicular direction along the perpendicular front side face **41***a* of each of the teeth **41** of the first rack part **40**. In other words, the holding member **64** is moved after the holding member **64** is lifted perpendicularly from the depression **38**. When the holding member **64** is moved backwardly until the point protrusion **85** points out the scale **50** positioned backwardly by 3 mm from the mark **51** as the reference position, the holding member **64** is descended to engage the second rack part **80** with the first rack part **40**, and the holding member **64** is fastened to the depression **38** by the screw B.

Next, with reference to FIG. **10**, a case where the sheet feeding cartridge **3** is inserted into the opening part **2***a* by strong force will be described. When the sheet feeding cartridge **3** is inserted by the strong force, backward force (refer to an outlined arrow in FIG. **10**) is applied from the stored sheets S to the rear cursor **24**. Accordingly, the backward force is also applied to the holding member **64** via the cursor rack **62** fixed to the rear cursor **24** and the pinion **63** engaging with the cursor rack **62**. However, movement of the holding member **64** in the forward and backward directions is restricted by the engagement of each of the teeth **81** of the second rack part **80** with the each of the teeth **41** of the first rack part **40** in the depression **38**. Therefore, backward movement of the holding member **64**, i.e., backward movement of the front cursor **23** and the rear cursor **24**, is restricted. Thus, the first rack part **40** and the second rack part **80** construct a movement restriction part restricting movement in the width direction of the pinion **63** supported by the holding member **64** and the pair of cursor racks **61** and **62** engaging with the pinion **63**.

Further, in the present embodiment, a perpendicular rear side face **81***b* of each of the teeth **81** of the second rack part **80** comes into contact with a perpendicular front side face **41***a* of each of the teeth **41** of the first rack part **40**. Therefore, the backward force applied to the holding member **64** is dammed, and then, the engagement of each of the teeth **81** of the second rack part **80** with each of the teeth **41** of the first rack part **40** is not released. Therefore, the backward movements of the rear cursor **24** and the front cursor **23** are more strongly restricted.

As described above, according to the present disclosure, the holding member **64** is configured to be attachable to and detachable from the bottom plate **20***a* of the main body part **20**, and then, to be supported with respect to the bottom plate **20***a* and allowed to move in the width direction of the sheet in a state that the engagement of the pinion **63** with the pair of cursor racks **61** and **62** is maintained, and to be fixed with respect to the bottom plate **20***a* in any optional position in the width direction of the sheet. Thereby, when the center position adjustment of the front cursor **23** and the rear cursor **24** in the width direction of the sheet is carried out, the holding member **64** holding the pinion **63** is moved with respect to the main body part **20** of the sheet feeding cartridge **3**, and thereby, it is possible to move of the front cursor **23** and the rear cursor **24** together with the cursor racks **61** and **62** engaging with the pinion **63**. Therefore, it is possible to easily carry out center position adjustment operation even in a narrow space.

In addition, sizes of the slide mechanism **25** of the front cursor **23** and the rear cursor **24** and the movement mechanism of the holding member **64** can be made smaller and the holding member **64** is stored in the depression **38** formed in the main body part **20**. Therefore, it is unnecessary to heighten a height of the sheet feeding cartridge **3**, and thereby, it is possible to cope with downsizing and space-saving of the sheet feeding cartridge **3**.

In addition, on the main body part **20**, a scale **50** denoting the reference position of the sheet holding member **64** in the width direction of the sheet and a moved amount from the reference position is formed, and moreover, in the holding member **64**, the point protrusion **85** (the point part) pointing out the scale **50** is formed. Therefore, it is possible to easily position the holding member **64** to the reference position and to easily comprehend the moved amount.

Further, once the center position adjustment is carried out by using the holding member **64**, the holding member **64** is fixed to the main body part **20** (the bottom plate **20***a*) by the engagement of the second rack part **80** with the first rack part **40**, and thereby, it is possible to make engagement force between the holding member **64** and the main body part **20** stronger. According to this, the holding member **64** is hard to move and displacement of the center position is hard to occur. Therefore, positional displacement between the pinion **63** and the pair of cursor racks **61** and **62**, i.e., positional displacement between the front cursor **23** and the rear cursor **24**, is hard to occur. Further, even when backward force is applied from the sheet to the rear cursor **24** in a case where the sheet feeding cartridge **3** is inserted by strong force and other cases, since the engagement of the holding member **64** with the main body part **20** is difficult to be released, it is possible to prevent displacement of the center position due to movement of the rear cursor **24**.

In addition, each of the teeth **41** provided in the first rack part **40** is formed so that the front side face **41***a* (an upstream side face) is perpendicular to the bottom plate **20***a* and the rear side face **41***b* (a downstream side face) is inclined to the bottom plate **20***a* in an installation direction (a direction parallel to the width direction of the sheet) into the housing **2** (the apparatus main body). In addition, each of the teeth **81** provided in the second rack part **80** is formed so that the front side face **81***a* (an upstream side face) is inclined to the bottom plate **20***a* and the rear side face **81***b* (a downstream side surface) is perpendicular to the bottom plate **20***a* in the installation direction (the direction parallel to the width direction of the sheet) into the housing **2** (the apparatus main body). Thereby, it is possible to surely prevent the movement of the holding member **64** in the installation direction. Accordingly, it is possible to prevent positional displacement of the front cursor **23** and the rear cursor **24** due to force applied from the sheet to the front cursor **23** and the rear cursor **24** when the sheet feeding cartridge **3** is installed into the housing **2** by strong force.

In addition, in the present embodiment, the sheet feeding cartridge **3** as the sheet feeding unit has been described. Meanwhile, the present disclosure may be applied to another sheet feeding unit, such as a manual feeding tray, a document conveying device or the like, including a mechanism for sliding a pair of cursors by a rack and pinion mechanism.

Further, the embodiment of the present disclosure was described in a case of applying the configuration of the disclosure to the printer **1**. On the other hand, in another embodiment, the configuration of the disclosure may be applied to another image forming apparatus, such as a copying machine, a facsimile, a multifunction peripheral or the like, except for the printer **1**.

Further, the above-description of the embodiments was described about one example of the image forming apparatus including this according to the present disclosure. However, the technical scope of the present disclosure is not limited to the embodiments. Components in the embodiment described above can be appropriately exchanged with existing components, and various variations including combinations with other existing components are possible. The description of the embodiment described above does not limit the content of the disclosure described in the claims.

What is claimed is:

1. A sheet feeding unit, that is attachable to and detachable from an apparatus main body, comprising:

a main body part having a bottom plate and configured to be arranged on which a sheet is placed;

a pair of side cursors supported by the bottom plate so as to slide in a width direction of the sheet to restrict a position of the sheet in the width direction;

a pair of cursor racks respectively extending from the pair of side cursors in directions opposing to each other in the width direction of the sheet;

a pinion engaged with the pair of cursor racks; and

a holding member having a shaft support part rotatable supporting the pinion,

wherein the bottom plate includes a pair of guiding protrusions arranged at a predetermined interval in the width direction,

the holding member includes a pair of slits elongated in the width direction and provided at both sides in the width direction,

the holding member is attachable to and detachable from the bottom plate, and configured to be supported so as to move in the width direction of the sheet with respect to the bottom plate by respectively inserting the pair of guiding protrusions into the pair of slits in a state that the engagement of the pinion with the pair of cursor racks is maintained, and to be fixed to the bottom plate in any optional position in the width direction of the sheet,

on the bottom plate, a scale denoting a reference position of the holding member in the width direction and a moved amount from the reference position is formed and, in the holding member, a point part pointing out the scale is formed.

2. An image forming apparatus comprising a sheet feeding unit according to claim **1**.

3. A sheet feeding unit, that is attachable to and detachable from an apparatus main body, comprising:

a main body part having a bottom plate and configured to be arranged on which a sheet is placed;

a pair of side cursors supported by the bottom plate so as to slide in a width direction of the sheet to restrict a position of the sheet in the width direction;

a pair of cursor racks respectively extending from the pair of side cursors in directions opposing to each other in the width direction of the sheet;

a pinion engaged with the pair of cursor racks; and

a holding member having a shaft support part rotatable supporting the pinion,

wherein the holding member is attachable to and detachable from the bottom plate, and configured to be supported so as to move in the width direction of the sheet with respect to the bottom plate in a state that the engagement of the pinion with the pair of cursor racks is maintained, and to be fixed to the bottom plate in any optional position in the width direction of the sheet,

on an upper face of the bottom plate, a first rack part in which teeth extending in an orthogonal direction to the width direction are provided along the width direction is formed and, on a lower face of the holding member, a second rack part in which teeth meshing with the respective teeth of the first rack part are provided is formed,

the first rack part and the second rack part are configured to construct a movement restriction part restricting movement in the width direction of the pinion supported by the holding member and the pair of cursor racks engaging with the pinion.

4. The sheet feeding unit according to claim **3**, wherein

an installation direction to the apparatus main body is a parallel direction to the width direction of the sheet,

each of the teeth provided in the first rack part is formed so that an upstream side face in the installation direction is perpendicular to the bottom plate and a downstream side face is inclined to the bottom plate, and

each of the teeth provided in the second rack part is formed so that an upstream side face in the installation direction is inclined to the bottom plate and a downstream side face is perpendicular to the bottom plate.

5. An image forming apparatus comprising a sheet feeding unit according to claim **4**.

6. An image forming apparatus comprising a sheet feeding unit according to claim **3**.

7. A sheet feeding unit, that is attachable to and detachable from an apparatus main body, comprising:

a main body part having a bottom plate and configured to be arranged on which a sheet is placed;

a pair of side cursors supported by the bottom plate so as to slide in a width direction of the sheet to restrict a position of the sheet in the width direction;

a pair of cursor racks respectively extending from the pair of side cursors in directions opposing to each other in the width direction of the sheet;

a pinion engaged with the pair of cursor racks; and

a holding member having a shaft support part rotatably supporting the pinion,

wherein the holding member is attachable to and detachable from the bottom plate, and configured to be supported so as to move in the width direction of the sheet with respect to the bottom plate in a state that the engagement of the pinion with the pair of cursor racks is maintained, and to be fixed to the bottom plate in any optional position in the width direction of the sheet,

the bottom plate includes:

a boss in which a screw hole is formed; and

guiding protrusions arranged at both sides of the boss in the width direction,

the holding member includes:

an long hole elongated in the width direction; and

slits elongated in the width direction and provided at both sides of the long hole in the width direction,

the holding member is slidably supported in the width direction by inserting the guiding protrusions into the slits, and fixed to the main body part by fastening a screw inserted through the long hole onto the boss in a state being slid to an optional position and being positioned.

8. An image forming apparatus comprising a sheet feeding unit according to claim **7**.

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